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Nutrient and pesticide fate and transport in an agricultural soil→groundwater↔surface water system at Fu River, China

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Introduction

Intense wheat-maize cropping systems are the dominant agricultural land use around Fu River in northeastern China. The perennial farming activities take place in close proximity to deep and shallow groundwater production wells and to Fu River, which - among other things - is used for duck-farming and fishing.

The application of fertilizers and pesticides is necessary to maintain agricultural productivity, but threatens the quality of the shallow groundwater and the surface water. A good understanding of the transport and degradation processes of these contaminants and knowledge about the interaction between contaminated surface waters with groundwater is therefore crucial for risk assessment and for effective water resource protection in this area.

Study aims

To obtain an understanding about the transport and fate of the agricultural key contaminants, a typical wheat-maize rotation in the agricultural region of Hebei Province, China, was chosen as study site.

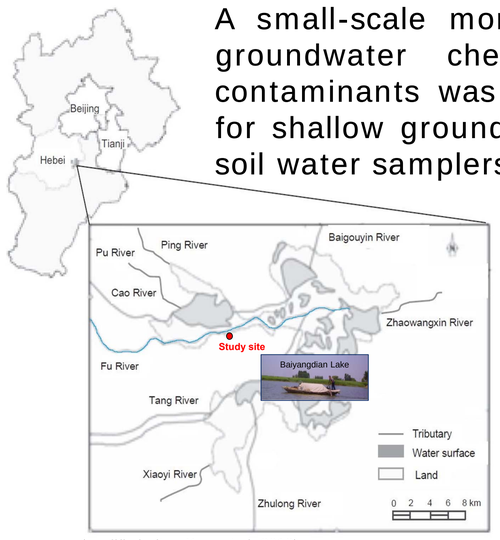
The aims of the study are:

- To identify flow and transport processes on site
- To compare water chemistry among different riparian zones (reed growth/no reed growth)
- To assess if the transfer and/or the degradation of contaminants differs depending on the local riparian vegetation

Study site and set-up

The study site is located at Fu River in Hebei Province near the Baiyangdian Lake area. Fu River is one of the major inflows to the lake.

A small-scale monitoring network for investigation of groundwater chemistry and to tracking of key contaminants was set up using small monitoring wells for shallow ground water (screened at 3m depth) and soil water samplers



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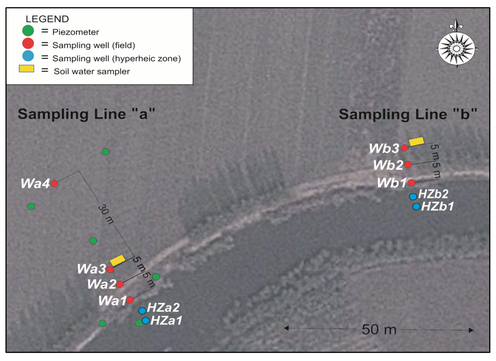

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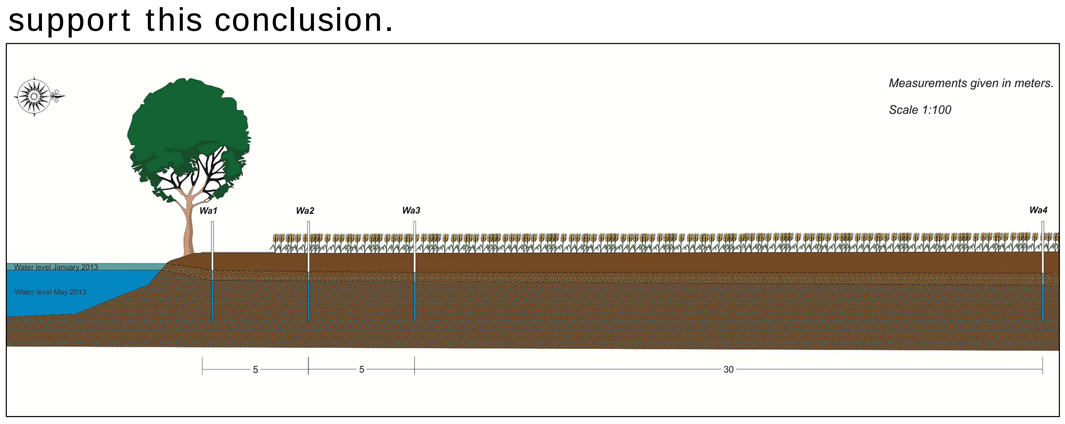
Preliminary results I

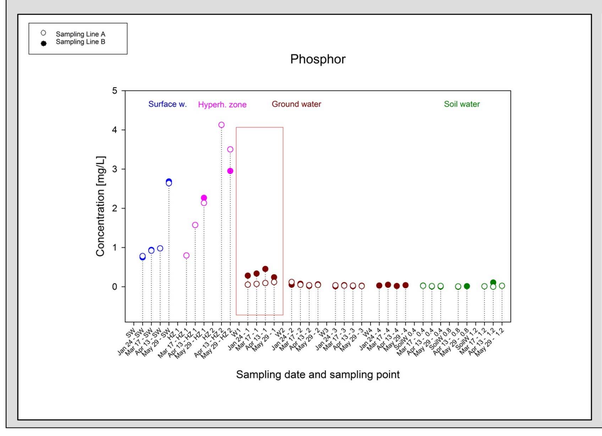
Divers were installed at 5 piezometers in the western part of the study site from November 2012 to June 2013. The obtained data incicates water flow from Fu River into the shallow aquifer with a hydraulic gradient from 0.8 to 1 cm/m (increasing after the sprouting of the winter wheat in the springtime).

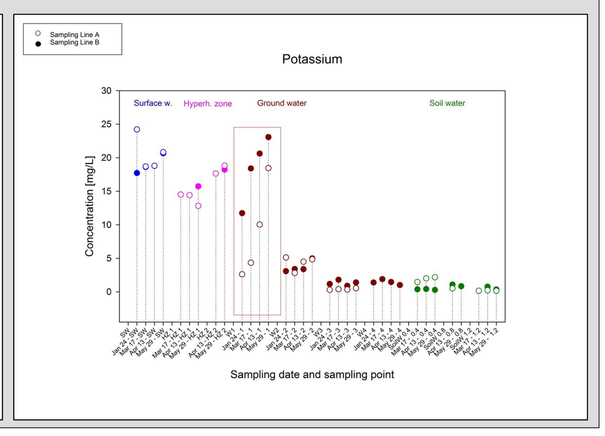
Temperature measurements and water chemistry data also support this conclusion.



Preliminary results II

The two sampling lines showed some differences in ground water chemistry at the wells located closest to the riparian zone (Wa1 and Wb1). Most significantly, lower values of phosphorus and of potassium were observed at Sampling Line B.
This might be attributed to uptake by the vegetation (reed and algae), which is more abundant at this location.





Conclusions and further work

The preliminary results of this study indicate that the different vegetation along the riparian zone causes different hydrochemical conditions. This may influence the transport and degradation of agricultural pollutants.

Much of the presented work is still in its initial stage and further measurements have to be taken to confirm this. Also, some parameters, including the concentration of various pesticides, have not been analyzed yet.

Before commencement of the study, the expected flow condition was a hydraulic gradient from the field toward Fu River. However, extensive rainfalls in fall 2012 all over the Northern China Plain have let to extremely high water levels in the local surface water bodies. Therefore, pollutants entering the ground water system the surface water may become of higher priority for this study, than initially expected.

References: Yang, W.; Yang, Z.F; Zheng, C. (2012): Sustainable environmental flow management based on lake quality protection: The case of Baiyangdian Lake, China. In *Procedia Environmental Sciences* 13, pp. 730–741.

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